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PATENT SPECIFICATION

Application Date: Dec. 22, 1943. No. 21468/43. 573,880

Complete Specification Accepted: Dec. 11, 1945.

COMPLETE SPECIFICATION

Improved Apparatus for Dehumidifying Air and Gases

I, FREDERICK OSBAND ANDEREGG, a citizen of the United States of America, of 18, Ardmore Street, Hamden, Connecticut, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to dehumidifying apparatus by means of which air or other gases are relieved of their moisture content.

A primary object of the invention is the provision for rapid, and substantially complete, continuous dehumidification in a simple and inexpensive manner.

Another object is the provision for continuous regeneration of the material used as a dehumidifying agent.

To this end, in accordance with the invention I provide dehumidifying apparatus comprising a wall formed of a hygroscopic, moisture-pervious substance, over one face of which wall (e.g. the outer face) gas to be dehumidified is adapted to be passed, and means for passing heated gas over and in direct contact with the opposite (e.g. inner) face of said wall for removing therefrom moisture absorbed from the gas to be dehumidified. Advantageously the apparatus comprises a housing having an inlet and an outlet, an open-ended tube of pervious water-absorptive material disposed within said housing, an inlet and an outlet for passing air or other gas to be dehumidified through said housing in intimate contact with the outer surface of said tube over substantially its entire length, a heat source at one end of said tube to cause relatively dry, heated air or gas to flow through said tube and a cooling coil disposed about the length of said tube within said housing and in intimate contact with the outer surface of said tube.

The use of a highly pervious, dehumidifying material as a wall between a flow of air or other gas to be dehumidified, and a flow of heated air or other gas acting as a regenerative medium results in a continuous regeneration of the dehumidifying material. The two flows, in contact with opposite faces of the dehumidifying wall or tube, are preferably in counter directions to enhance the respective actions thereof.

The provision of a cooling coil, through which water is preferably circulated, permits of absorbing the latent heat of vaporization set free by condensation of the moisture in the air or other gas being dehumidified.

In order that the invention may be clearly understood and readily carried into practice, reference will now be made to the accompanying drawings, in which the invention is illustrated by way of example, and in which:

Fig. 1 represents a vertical section taken centrally through a preferred embodiment of the invention, the mid-portion being illustrated partly in elevation; and

Fig. 2 represents a horizontal section taken on the line 2—2 of Fig. 1.

Dehumidification in accordance with the invention is advantageously accomplished by the use of a tube of highly previous dehumidifying material so that a maximum effective dehumidifying surface area is obtained.

It is preferred that the dehumidifying material employed be calcium hydrosilicate or calcium hydro-aluminate or a combination of the two, incorporated with calcium chloride or other hygroscopic agent, as described in my United States Patent No. 2,255,041.

Such material may be moulded into desired shape in its formative stage. It is extremely porous throughout, and the individual pores thereof intercommunicate so that distribution of absorbed moisture, and passage thereof through the body of the material, is facilitated. Further, the body of the material is rendered chemically hygroscopic by reason of the calcium chloride or like hygroscopic constituent.

While the above specified dehumidifying material is particularly advantageous because of its peculiar characteristics, other materials may be successfully used.

In the preferred embodiment illustrated, a tube 10 of highly porous dehumidifying material as above referred to

is set into a cylindrical housing 11, which may be conveniently formed from sheet metal. The tube 10 extends longitudinally through the housing 11, passing through aligned receiving apertures preferably formed centrally of opposite end plates 12 and 13 of the housing. Flange collars 12*a* and 13*a* may be struck from the respective end plates, circumferentially of the respective receiving apertures, for anchoring the tube 10 in position.

The housing 11 forms a chamber 14 completely surrounding the greater portion of the length of the tube 10. Through this chamber the air or other gas to be dehumidified is passed. For this purpose, a supply conduit 15 leads into the top of the housing 11 through a suitable receiving aperture provided in the upper end plate 12 to one side of the aperture through which the tube 10 extends. The supply conduit 15 is connected to the source of the air or other gas to be dehumidified (not shown), and, if found desirable in any particular instance, a conventional type of blower may be utilized to induce a positive flow through such supply conduit toward the chamber 14.

A discharge conduit 16 leads from the bottom of the housing 11 through a suitable receiving aperture provided in the lower end plate 13, preferably at a side of the housing 11 which is opposite that into which the supply conduit 15 directly leads.

Heated, relatively dry air or other gas is passed upwardly through the tube 10. For supplying the same, a gas burner 17 may be disposed at the lower end of the tube 10 so that air heated thereby will pass upwardly through the hollow interior of tube 10, as in a chimney. The heated, relatively dry air or other gas may be supplied in any other suitable manner, however, as for instance by connecting a conduit, leading from any suitable source of the heated, relatively dry air or other gas, to the bottom end of the tube 10. The spent heated air or other gas may pass freely out of the top of the tube 10 after traversing the length thereof, or, if desired, discharge piping (not shown) may be connected to the upper end of the tube 10.

Air or other gas to be dehumidified is supplied to the interior of the casing 11 through the supply conduit 15, and is withdrawn therefrom through discharge conduit 16. In its consequent downward flow through the chamber 14, such air or other gas to be dehumidified passes over the outside wall surface of the dehumidifying tube 10, in intimate contact therewith, and gives up its moisture content to that wall surface. The heated air or other gas flows upwardly within the tube 10, passing over the inside wall surface of the dehumidifying tube 10, and by reason of its dry character, vaporizes and carries off moisture from such inside wall surface. Because the entire body of the wall of tube 10 is pervious to moisture, the flow of heated air or other gas continuously and effectively regenerates the dehumidifying outer surface of the wall of tube 10.

Means for absorbing the latent heat of condensation released adjacent the dehumidifying outer walls of the tube 10, may be provided in the form of a coiled pipe 18, advantageously of copper, and forming a component part of a circulation system of any desired type (not shown) whereby water, or other cooling fluid, is circulated continuously through the piping.

The specifically illustrated and described embodiment represents a very advantageous practical utilization of the generic concepts of the invention. It should be realized, however, that many changes may be made in such embodiment and many other embodiments may be made by those skilled in the art without departing from the spirit and purview of the invention as set forth herein and in the following claims.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Dehumidifying apparatus comprising a wall formed of a hygroscopic, moisture-pervious substance, over one face of which wall (e.g. the outer face) gas to be dehumidified is adapted to be passed, and means for passing heated gas over and in direct contact with the opposite (e.g. inner) face of said wall for removing therefrom moisture absorbed from the gas to be dehumidified.

2. Dehumidifying apparatus according to Claim 1, wherein the said wall is formed by a cylindrical tube adapted for the passage of heated gas therethrough, said tube being mounted within a casing between which and the tube the gas to be dehumidified is adapted to be passed.

3. Dehumidifying apparatus according to Claim 2, wherein a source of heating is provided at the inlet of said tube.

4. Dehumidifying apparatus according to any of Claims 1 to 3, wherein a heat transfer element is disposed in contact with that face of said wall over which the gas to be dehumidified is adapted to be passed, and is designed to remove the

latent heat of condensation of moisture in this gas.

5. Dehumidifying apparatus comprising a housing having an inlet and an outlet, an open-ended tube of pervious water-absorptive material disposed within said housing, an inlet and an outlet for passing air or other gas to be dehumidified through said housing in intimate contact with the outer surface of said tube over substantially its entire length, a heat source at one end of said tube to cause relatively dry, heated air or gas to flow through said tube, and a cooling coil disposed about the length of said tube within said housing and in intimate contact with the outer surface of said tube.

6. Dehumidifying apparatus substantially as herein described with reference to the annexed drawings.

Dated the 22nd day of December, 1943.
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Fig.1.

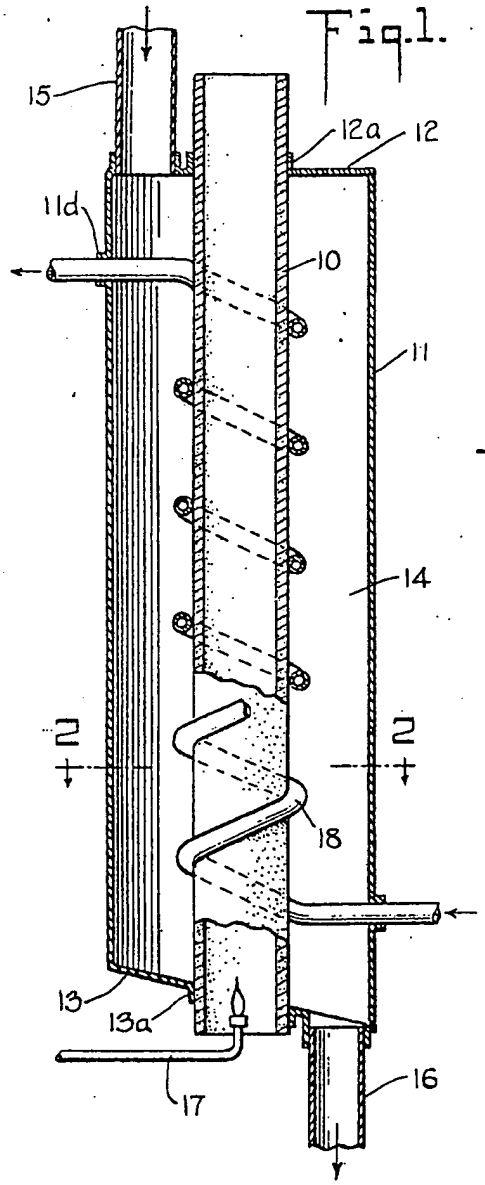
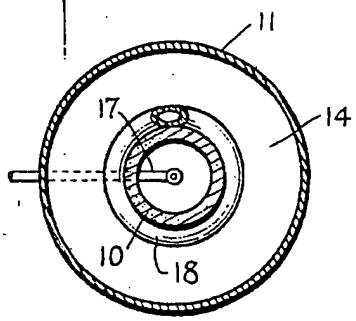


Fig.2.



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